Changes In Groundwater And Its Outcome On Human Society Of Ramgarh District, Jharkhand

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Changes In Groundwater And It's Outcomes On Human Society Of Ramgarh District, Jharkhand

1. INTRODUCTION

Groundwater is the water present beneath land surface in rocks and soil pores spaces and in the fractures of rock formations. It is stored in and moves slowly through geologic formation of soil, sand and rocks called aquifers. “Groundwater refers to all the water occupying the voids, pores and fissures within geological formations, which originated from atmospheric precipitation either directly by rainfall infiltration or indirectly from rivers, lakes or canals. The chemical, physical and bacterial characteristics of groundwater determine its usefulness for various purposes.”(Ojo 2012). Groundwater is the second largest source of freshwater after ice-caps and sheets available on Earth. “This source is estimated to contain more than 100 times that available from streams and freshwater lakes.”(Brands 2016). “It is used for industrial, agricultural and domestic purposes and fulfills more than one-third of global drinking water demands” (Katsanou and Karapanagioti,2017; Carrard et al., 2019). Moreover, it provides resilience to drought at the initial phase and is an alternative source of water for drought mitigation (Al Adeilahet al., 2019 Langridge and Van Schmidt, 2020). Water is addressed as a necessary resource and life preservative. It is required for most human activities like drinking, cooking, bathing, washing, agriculture, industry, recreation, navigation and fisheries etc. “With the growing population the demand of water in various forms has increased. As the availability is limited and the demand is high there is an increasing trend in over exploitation of water and the mode is unsustainable in a way as there is gap between availability and the demand of this valuable water resource” (Kumar et al., 2005). As a result of which the government of India has established Central Groundwater Board (CGWB) in 1970 under the Ministry of Agriculture to asses and regulate groundwater throughout the country (Central Groundwater Board 2004). The CGWB and Groundwater Resource Estimation committee in association with state groundwater board has established various scientific methods to estimate groundwater resource (Groundwater resource Estimation Committee, 2009). In Jharkhand 287 wells were being monitored for estimating groundwater recharge (Jharkhand Groundwater Board 2013). About 75% of the world’s surface area is covered with water. Out of which 97% of the earth’s water is in the ocean, not fit for human use due to its high salt content. Remaining 2% is locked in polar ice caps and only 1% is available as freshwater in rivers, lakes, streams, reservoirs and groundwater, suitable for human consumption. In Ramgarh district there are many industrial areas like Patratu Thermal Power Plant, Bhurkunda (Glass Factory) and Coal Mining Areas, viz., Barkakana, Kuju, Mandu and Rajrappa. There we find many coal washeries also. Ramgarh district is a part of Pre-cambrian segment of Chotanagpur plateau forming a narrow trough in which lower Gondwana rocks were deposited. This research proposal outlines a study aimed at assessing the Changes in Groundwater and Its outcome on Ramgarh District. The study will investigate the Groundwater's influence on various aspects of the local economy, society and environment.

2. State of the Art

Considering 'Groundwater changes' as a core, a lot of research has been done by the researchers which shows not only the changing nature of ground water but also the Significance for the

people. Central Ground Water Board has established a network of observation wells for monitoring groundwater level to know the behavior of groundwater regime in the district. There are seven monitoring stations which are monitored every year in January, May, August & November. The data shows that the water level trend is declining at the rate of <1metre/year in the last decades. In the study area, Ramgarh block also comes in an over-exploited block where existing gross groundwater draft for domestic and industrial water supply is 944 ham (Hydrogeochemical Assessment Model) and existing gross ground water draft for irrigation is 1052 ham. The total ground water draft for all uses is 1997 ham, making the stage of ground water development 105.26%. When assessing the draft for Ramgarh block, it is observed that the irrigation ground water draft contributes towards higher as compared to the domestic and industrial draft.

"Analysis of groundwater anomalies using GRACE over various districts of Jharkhand". (Arpita Verma, Anant Kumar, C Jeganathan, Sanjay Kumar 2016)[5].

"Regional monitoring of temporal changes in groundwater quality".(Hans Peter Broers, 2004)[6]"This study aimed to improve the detection and understanding of groundwater quality changes with time, combining time series information, concentration–depth profiles, age dating and concentration–depth prognosis based on the historical inputs of solutes.

"Observed groundwater temperature response to recent climate change" (Kathrin Menberg, 2014). Findings demonstrated that shallow groundwater temperatures have responded rapidly to recent climate change and thus provide insight into the vulnerability of aquifers and groundwater-dependent ecosystems to future climate change. "Impact of land use and land cover change on groundwater recharge and quality in the southwestern US". (Bridget R Scanlon, 2005).

"Global change and the groundwater management challenge."(M Gorelick, 2005).

"Soil profile evolution following land-use change: Implications for groundwater quantity and quality". (Tianming Huang 2013). "Change in plant associations by change in groundwater level". (Kirk Bryan, 1928). "Regression analysis for anomalous changes of ground water level due to earthquakes". (Norio Matsumoto, 1992).

"Impacts of climate change on groundwater level and irrigation cost in a groundwater dependent irrigated region". (Golam Saleh, 2018).

"Declining groundwater level and aquifer dewatering in Dhaka metropolitan area, Bangladesh: causes and quantification". (Mohammad Haque, 2007). The city is almost entirely dependent on groundwater, which occurs beneath the area in an unconsolidated Plio- Pleistocene sandy aquifer. Analysis shows that the pattern of water level change largely replicates the patterns of change in the rate of groundwater abstraction.

"Detection of coseismic changes of underground water level". (Genshiro Kitagawa, 1996) "Influence of underground structures and infrastructures on the groundwater level in the urban area of Milan, Italy."(Loris Colombo, 2017). "A case study on the effects on underground structure due to changes in the groundwater level and ground stress". (Jeeseung Chung, 2015) "Experimental analysis on the interaction between underground structures and sand layers under groundwater level change". (Hanlong Liu, 2023) "Assessment of groundwater level fluctuation by using remote sensing and GIS in West Bokaro coalfield, Jharkhand, India". (Akashwani Kumar Tiwari, 2016)."Assessment of heavy metal pollution in groundwater of an industrial area: a case study from Ramgarh, Jharkhand, India". (Suresh kr, Sunil toppo, 2016)

"Hydrogeochemical processes and quality assessment of groundwater in Dumka and Jamtara districts, Jharkhand, India". (Abhay kr Singh, 2012). The hydrogeochemical study of groundwater in Dumka and Jamtara districts has been carried out to assess the major ion chemistry, hydrogeochemical processes and groundwater quality for domestic and irrigation uses.

"Hydrogeochemical Characterization and Qualitative Assessment of Groundwater in Jampali Coal Mining Area, Chhattisgarh, India". (Shah Izhar Ahmed, 2022).

"Delineation of groundwater potential zones using geospatial techniques and analytical hierarchy process in Dumka district, Jharkhand, India"(Preetilata murmu,2019).

Study aimed to delineate groundwater potential zones using an integrated approach of remote sensing, GIS. Many of the things are to be done in Ramgarh district related to groundwater changes. For example, the level of the water table, variations of changes in the entire region, dependency of people on it, significance of Ground water etc.

3.) Problems to be investigated

For a research study on the Changes in the Ground water level and its outcome on human society, several key problems can be investigated to gain a comprehensive understanding of the groundwater's impact.

Some problems to be investigated for the research may include:

a). What are the spatial locations and extensions of over-extraction of Ground water?

b). What are the challenges faced by women in the utilization of ground water?

c). What are trends of declining Groundwater level in the district?

d). What are the impacts of Urbanization on aquifers?

e). What are the overall social and economic significance of Ground water level in Ramgarh district?

During the course of the research work, new challenges of investigation might open up which may also be explored.

4) Objectives of the investigation and motivation

By addressing the following research objectives, the study aims to provide comprehensive insights into the multi-faceted changes in Ground water and it's outcome on human society.

1. To analyze the temporal variation of groundwater in the area during the study time period
2. To find out the spatial variations of Groundwater quality.
3. To examine the avenues of dependency of human society on Groundwater such as domestic uses, irrigation, constructions etc.
4. To find out the outcomes of changes in Groundwater on people of the district.
5. To find out the challenges and potential sustainable use of Groundwater in the region.

This research study will also discuss the avenues of dependency such as irrigation, domestic purposes, cottage industries, etc., and will explore the additional costs incurred due to deep boring caused by the decline in groundwater levels, based on both positive and negative aspects. The focus will also be on potential future aspects and solutions to the problems that may arise here.

5) Research Questions (Hypothesis)

- There is decline in ground water level in Ramgarh district over the study time period.
- Changes in groundwater causes financial burden on the people of the region.
- The water table decline in urban areas is higher than rural areas.

These research questions expect Ground water to have a substantial impact on the socio-economic aspects of the region. Throughout our research, we will aim to verify statements by collecting and analyzing data.

6) Research design and Methodology

a) Selection of study area.

Ramgarh district is located in the North eastern part of the state of Jharkhand. Ramgarh district covers an area of approximately 1341 km^2. This district is the center of the Tri-important districts of Jharkhand namely Ranchi, Hazaribagh, and Bokaro. This proximity facilitates economic and social interaction. In the study area, Ramgarh block also comes in an overexploited block where the existings gross ground water draft for domestic and industrial water supply is 944 ham (hydrogeochemical Assessment Model) and existing gross ground water draft for irrigation is 1052 ham. The total ground water draft for all uses is 1997 ham, making the stage of ground water development 105.26%. When assessing the draft for the Ramgarh block, it is observed that the irrigation ground water draft contributes towards higher as compared to the domestic and industrial draft. Its location near coal mines is advantageous for the energy intensive industries such as it hosts major industries like CCL and several still plants.

• District is characterized by undulating terrain with hills, plateaus and valleys.
• It is part of the Chotanagpur plateau which is known for its mineral rich land.
• Damodar River flows through the district creating river valleys and fertile plains along its banks.
• The strength of the district depends upon its topography as it contains coal, iron, sand etc. resulting in the positive development of the region.

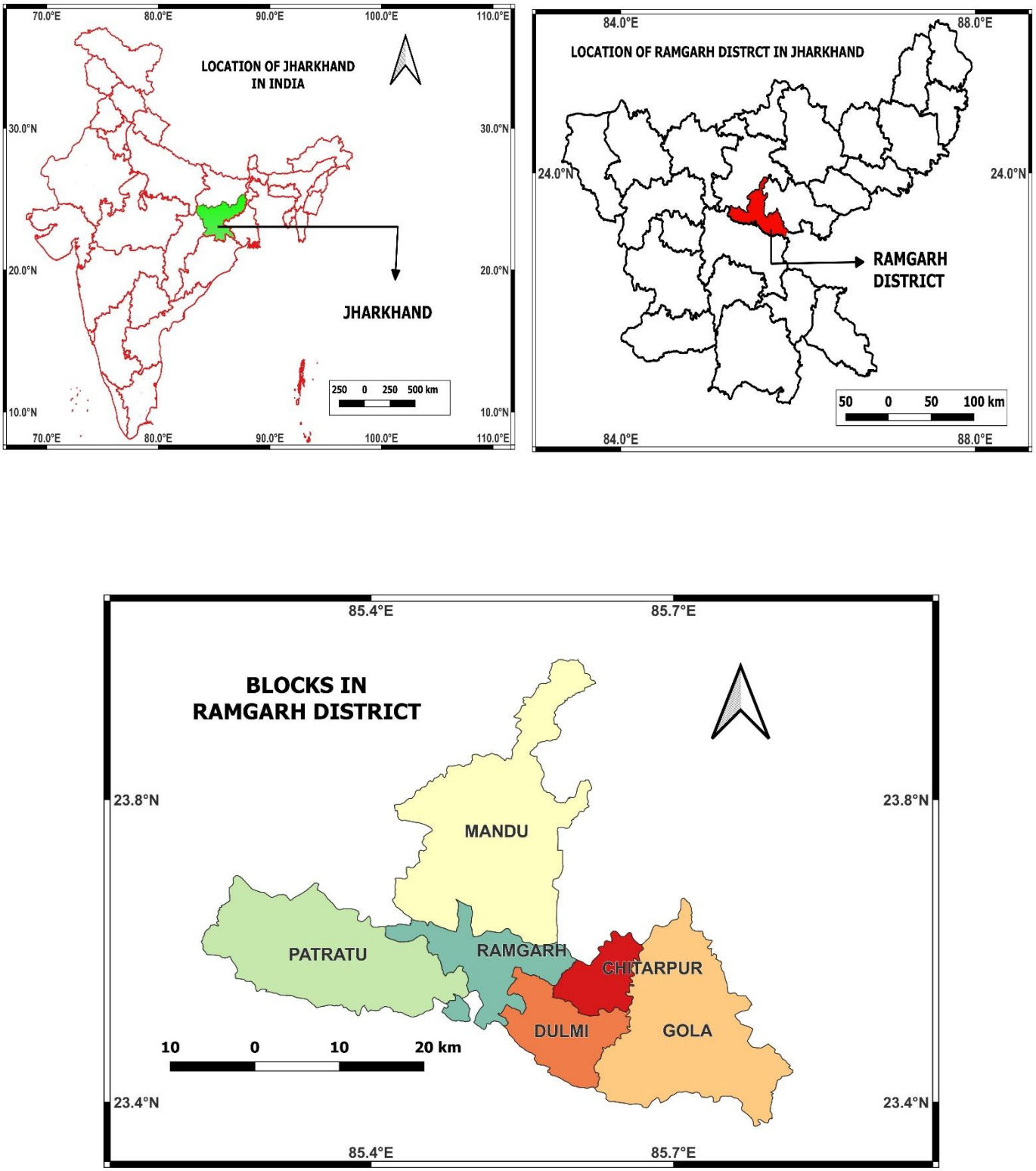

Fig:- Location and Administrative Maps of Study Area

b) Methodology:

Pre field: To locate areas to study, choose samples, prepare questionnaires.

Literature review: Review existing literature, research papers, and reports related to Groundwater changes, and its significance.

Data collection: Conducting surveys, interviews, and focus group discussions with local people, farmers, and relevant government authorities to gather data. Secondary data on Household data, sources of water, urban and rural areas, etc. can be collected. Data for water quality assessment will be based on parameters such as pH, salinity, TDS (Total dissolved solids) , EC(Electric Conductivity) etc.

Sample design: The sampling for water table, water quality and socio-economic aspects shall consist of 10 samples from each of the 6 blocks at least twice a year (Pre-Monsoon and Post-Monsoon) for 3 initial years of the study time period. 5 samples of well and head of the household from headquarter area, and 5 samples from two proximate villages of each block headquarter will be chosen. This shall result in an approximate 120 samples for one year for the purpose of the study. In the initial three years there will be around a total 360 samples. Based on the results, sample collection for next year will be considered.

Field visits: Visit the areas to record the fluctuations and to observe their livelihood conditions and also dependency on ground water. Field visits can be timed in a manner to observe seasonal changes in groundwater.

Data analysis: The collected water samples shall be analyzed by pen type of water quality meter after proper calibration of the instrument. Data analysis can be done using statistical tools and qualitative methods to draw meaningful insights. Software's such as SPSS, QGIS, ERDAS, etc. can be put to analyze. For this descriptive and inferential analysis can be used as and where required.

d) Tentative Chapterization:

Introduction

Chapter 1: Geographical background of Study Area

Chapter 2: Spatio-Temporal conditions of Ground water

Chapter 3: People's Dependency on Groundwater

Chapter 4: Groundwater comparison of Urban and Rural areas

Chapter 5: Outcomes of changes in Groundwater on Human Society

Chapter 6: Issues challenges and prospects in groundwater in the area

Case studies

Conclusion

Bibliography

Appendix

7) Sources of data and tools to be used in collection of data

Data Collection: Primary data can be gathered for the study by conducting ground surveys, interviews, and focus group discussions with the people who have borings and bore wells, farmers, and relevant government authorities. Data shall also be available from Central Groundwater Board, Central and state government agencies etc. which can be used for secondary data. GPS/ geo-tagged images from mobile phones can be used to record the location of wells, borings and maps can be produced showing spatial distribution of Groundwater in the area. Questionnaire, schedule methods can also be used for collecting certain information. For the study periodic visits to the Rural and Urban areas and to observe the fluctuations, therefore collecting relevant data.

8) Analysis of Data

Analyzing data while researching problems and prospects of Changes in Groundwater in Ramgarh District involves several steps to draw meaningful insights and conclusions. For this descriptive and inferential analysis can be used as and where required. Cleaning the data to remove any errors and ensure data is properly formatted and organized for analysis. Statistical tools such as mean, median, standard deviation can be used to better understand the data. Hypothesis Testing may also be conducted while analyzing the data through available statistical tests such as appropriate for the collected data. Finally, Interpretation and Discussion of the results obtained from the data analysis. It is important to use appropriate statistical software and tools for data storage and analysis such as IBM SPSS, R, etc. and for mapping QGIS, ArcGIS applications can be used. To locate prospects and probable sites of depleted groundwater satellite imagery with good spatial resolution can be used.

9) Significance of the study

This research will contribute to our understanding of the interplay between natural resources and anthropogenic needs. It will help in sustainable water use, predicting potential droughts or floods, and safeguarding ecosystems that depend on groundwater. It can inform policy decisions and strategies for sustainable development in regions facing similar challenges. This research will also discuss the development of the region through putting efforts by the local community and the government as well. In this research, not only the depletion of groundwater shall be looked at but also the problems related to it will be discussed and attention shall also be given to its solutions to solve this problem.

10) Relevance to present day problems and need to the society

This Research on 'Changes in Groundwater and it's outcome on human society of Ramgarh District' holds significant relevance for society for several reasons: This research talks, what are the problems of the local communities there and what can be done for them?

Through this research, we can find out the different aspects of the local communities, especially farmers and rural people there. We can see the changing nature of groundwater and measures can also be taken to improve its water level and quality. Factors like rapid urbanization, industrial activities, and agricultural practices can contribute to these problems. Local

authorities and environmental agencies typically monitor and address such issues, aiming to implement sustainable groundwater management practices and ensure the wellbeing of the community. We can also find out what else the government and companies can do for the local people so that the committee becomes progressive.
Policy Formulation: Policymakers can use this knowledge to develop targeted policies.
Regional development: The research can highlight the role of Groundwater in contributing to people's regional development.
Overall, the research on the 'Changes in the Groundwater and its outcome on humans can have far-reaching implications for the well-being and prosperity of the local population.

11.) Contribution to existing knowledge

Conducting research on the Changes in Groundwater and it's outcome to Ramgarh District can make valuable contributions to existing knowledge in several ways:
Regional Context: The research will provide specific insights into groundwater problems to the Ramgarh District. It will offer a localized understanding of how water contributes to the region's development, which can be used as a reference for similar areas facing comparable challenges and opportunities. By collecting and analyzing data from the region, the research will offer empirical evidence on the actual contribution of activities related with underground water and its development, and to remove other depleting factors. This data-driven approach can strengthen the understanding of the development of the region based on the water and inform evidence-based policies and the information will be fruitful for the future perspective.

12.) Future work:-

Some potential areas for future research include:
Long-Term Impact Assessment: Conducting longitudinal studies to track the long-term impact due to Changes in Groundwater on human society of Ramgarh district. This would attract research on how the ground water and other dynamics such as river water, Mining sites, fishing etc contributions evolve overtime and its sustained effects on the region's development.

Comparative Studies: Undertaking comparative studies between different regions or districts to assess variations in the Ground water
changes in Ramgarh district. Comparing areas with varying water level, people's access to it, and policy frameworks can reveal best practices and lessons for informed decision making.

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